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The changes in morphology of the wear-resistant ZrN coatings surfaces under the influence of the third elements additives

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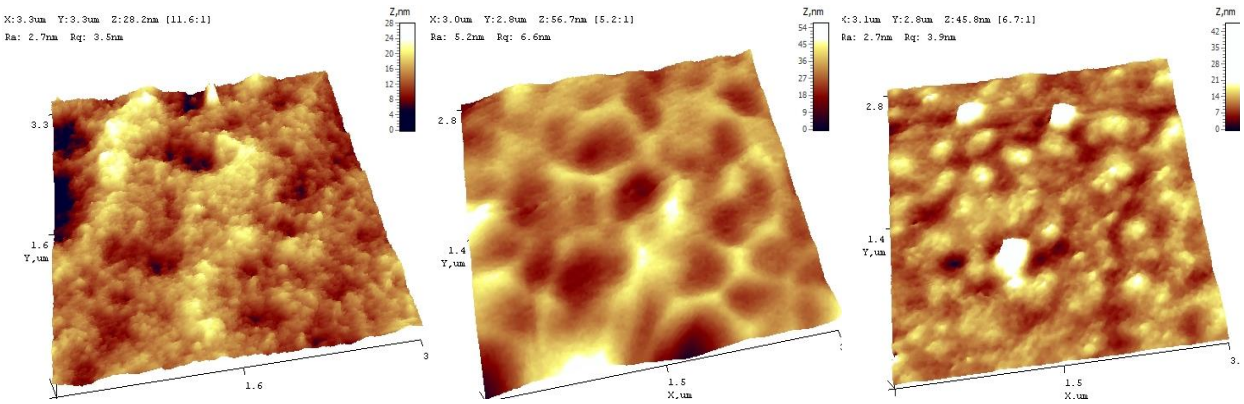
The transition metal nitrides coatings are widely applied for cutting tools and tribological surfaces. ZrN coatings occupy a special place among them [1,2]. They have a favorable combination of mechanical properties under conditions requiring high thermal stability. The coatings on the base ZrN are known as a decorative thin films with color dependent on their chemical composition.

ZrN, Zr-O-N and Zr-Si-N coatings were synthesized using cathodic arc evaporation on HS6-5-2 steel substrates. Tribological properties of coatings are largely determined by the properties and morphology of their surface. The purpose of this work was to determine the effect of additives of Si and O on the morphology of the surface of wear-resistant ZrN coatings. The studies were carried out on an atomic force microscope (AFM) of the model NT-206 (Belarus).

ZrN, Zr-O-N and Zr-Si-N coatings show classical surface microstructure characteristic for coatings deposited using PVD methods, especially cathodic arc evaporation. On the coating surface the numerous craters and a macroparticles are apparent. The surface microstructure is one of the most important parameter of the coatings. The surface obtained by AFM as 3D images is interpreted for ZrN coatings as a consisted from grains with diameter less than 50 nm structure, for Zr-Si-N coatings as a multi-cell structure in which lowered bottom of the cells and elevated vertical grain boundaries are visible, for Zr-O-N coatings as a consisted from the rounded "large" crystallites with diameter about 300 nm (Fig.1).



(a) (b) (c)

Figure 1. Three-dimentional images, scanned area 3x3 μm^2: (a) ZrN, (b) Zr-Si-N (2,2 % Si), (c) Zr-O-N (10 % O).

1. T.A. Kuznetsova, M.A. Andreev, L.V. Markova, *Friction and Wear* **26**, 521 (2005).
2. T.A. Kuznetsova, *Friction and Wear* **27**, 69 (2006).